

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Let $f: A \rightarrow B$ and $g: B \rightarrow C$ be both one to one and onto functions. Then $(g.f)^{-1} = f^{-1} . g^{-1}$.
17. Using indirect method or proof, derive $P \rightarrow \neg S$ from $P \rightarrow Q \vee R$, $Q \rightarrow \neg P$, $S \rightarrow \neg R$, P .
18. Solve the recurrence relation $s(k) - 4s(k-1) - 11s(k-2) + 30s(k-3) = 0$, $s(0) = 0$, $s(1) = -35$, $s(2) = -85$.
19. Verify whether the following system of equations is consistent. If it is consistent, find the solution

$$x - 4y - 3z = -16$$

$$4x - y + 6z = 16$$

$$2x + 7y + 12z = 48$$

$$5x - 5y + 3z = 0.$$
20. Let G be an undirected graph. Then G is bipartite iff it contains no odd cycle.

NOVEMBER/DECEMBER 2025

23PCA11 — DISCRETE MATHEMATICS

Time : Three hours

Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

Define the term Function.

What is composition of two functions?

3. Define the term DNF.
4. Write the truth table for $p \rightarrow q$.
5. Define the term Recurrence relation.
6. Find the recurrence relation for the Fibonacci sequence.
7. Define the terms Singular and Non-singular matrix.
8. State any two properties of the Eigen values.
9. Define the term bipartite graph.
10. Define walk in graph G .



SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Let $A = \{a, b, c, d\}$ and R the relation on A

that has the matrix $M_R = \begin{pmatrix} 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{pmatrix}$.

Construct the digraph of R and list the indegrees and outdegrees of all vertices.

Or

- (b) Let a relation R be defined on the set of all real numbers by if x, y are all real numbers, $xRy \Leftrightarrow x - y$ is a rational number. Show that the relation R is an equivalence relation.

12. (a) Write each of the following in symbolic form:

- (i) All men are giants.
- (ii) No men are giants.
- (iii) Some men are giants.
- (iv) Some men are not giants.

Or

- (b) Find PDNF and PCNF for $(P \wedge Q) \vee (\neg P \wedge Q) \vee (Q \wedge R)$

13. (a) Find the recurrence relation satisfying $y_n = A(3)^n + B(-4)^n$.

Or

- (b) Solve the following recurrence relation $D(k) - 8D(k-1) + 16D(k-2) = 0$ where $D(2) = 16, D(3) = 80$.

- (a) Find the rank of the matrix

$$A = \begin{pmatrix} 4 & 2 & 1 & 3 \\ 6 & 3 & 4 & 7 \\ 2 & 1 & 0 & 7 \end{pmatrix}$$

Or

- (b) Using Cayrey-Hamilton theorem find the

inverse of the matrix $\begin{pmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{pmatrix}$.

15. (a) Prove that in any graph, the number of vertices of odd degree is even.

Or

- (b) Prove that in any graph G , $\sum_{U \in V} d(G) = 2m$ where m is the number of edges of graph G .

